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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/893,577	06/29/2001	Masahiro Tadokoro	501.40201X00	5596

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EXAMINER	
CHEN, KIN CHAN	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 04/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/893,577	TADOKORO ET AL.	
	Examiner	Art Unit	
	Kin-Chan Chen	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *March 10, 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6 and 9-40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *22-40* is/are allowed.

6)☒ Claim(s) *1-6 and 9-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114 (March 10, 2004), including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 30, 2004 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-6 and 9-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamada et al. (US 6,159,862; hereinafter "Yamada") as evidenced by Collins et al. (US 6,238,588 B1), Jeng et al. (US 5,282,925), and Toprac et al. (US 6,238,937).

In reference to claims 1, 9-11, 18-21, Yamada teaches that a silicon nitride insulating film may be deposited on a semiconductor substrate. A silicon oxide insulating film may be deposited on the silicon nitride insulating film (or on a semiconductor substrate). A hard mask may be formed on the silicon oxide insulating film. See col. 7, lines 30-59; Fig. 2. The semiconductor substrate may be subjected to a plasma etching treatment through the hard mask as an etching mask using an etching gas containing C_5F_8 (or fluorocarbon), oxygen, and a dilution gas (e.g., Ar) to process the silicon oxide insulating film. During the process, the etching gas has been fed into the treatment chamber and a high-density plasma is excited (so –called plasma density ranges from $1x10^{10}$ to $1x10^{12}$ /cm^3 (or $1x10^{13}$ cm^3) in instant claims 9, 10, 28, and 29). See col. 8, lines 16.

Yamada does not disclose the residence time of the etching gas that is used in its process. The instant claims differ from Yamada by specifying various residence time of the etching gas (such as 50-700 ms in claims 1 and 22, 50-350 ms in claim 18, 100-200 ms in claim 19). However, it would have been obvious to one of ordinary skilled in the art to determine the suitable residence time through routine experimentation to obtain the best etched product achievable because the skilled artisan understands that the residence time is directly related to the amount of reactive gas dissociation occurring in the plasma, the longer a gas molecule remains exposed to a plasma, the more likely it is that dissociation of the gas molecule will continue. See evidences in Collins et al. (US 6,238,588 B1), Jeng et al. (US 5,282,925), and Toprac et al. (US

6,238,937) in the record. The cited evidences are only to show that residence time is a recognized result-effective process variable.

In reference to claims 2, 5, 16, 17, 20, and 21, Yamada teaches that the pressure within the etching chamber may be 30 mTorr (col. 11, line 12). The instant claims differ from Yamada by specifying various pressures (or partial pressures of C_5F_8) within the etching chamber (such as 0.7 to 7 Pa in claims 2 and 20; 1.3 to 4 pa in claims 5 and 21; 0.02 to 0.2 Pa of C_5F_8 in claim16; 0.04 to 0.1 pa of C_5F_8 in claim 17). Yamada teaches examples of the process variables including pressure (col. 8, lines 1-16), and discloses that the process variables may be changed for different etching results (col. 8, lines 42-47). Since pressure (pressure or partial pressure of each gas) in the chamber is known to be result-effective variable, it would have been obvious to one of ordinary skilled in the art to determine the optimum, operable range in order to produce the best etched product achievable.

In reference to claims 3-6, 12, 13, and 21, Yamada teaches that that total flow rate of the etching gas may be at 780 cm^3 / minute (col. 5, line 64), which is within the range cited. The flow rate of dilution gas is larger than the flow rates of the fluorocarbon gas and oxygen (instant claim 6). The instant claim 20 differs from the Yamada by specifying 700 cm^3 / minute. Since the flow rate of Yamada is close enough that one skilled in the art would have been expected to have the same properties.

As to claims 14, and 15, Yamada teaches the ratio of the flow rate between the oxygen and C_5F_8 (col. 5, line 48).

Yamada teaches that the temperature at the inner wall surface of the chamber may be 60 °C and may be 40 °C at lower electrode. Yamada does not disclose the temperature of the substrate being plasma etched in its process. The instant claims differ from Yamada by specifying the temperature of the substrate, however, the temperature of the substrate is commonly determined by routine experimentation. It would have been obvious to one of ordinary skilled in the art to optimize the temperature through the routine experimentation in order to produce an expected result.

Changes in compositions, temperature, concentrations, or other process conditions of a process do not impart patentability unless the recited ranges are critical (i.e., they produce a new and unexpected result that differs in kind and not merely in degree from the result of the prior art). *In re Woodruff*, 16USPQ2d 1934,1936 (Fed. Cir.1990); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809; *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

CRITICALITY OF PROCESSING PARAMETERS

"Where the principal difference between the claimed process and that taught by the reference is a temperature difference, it is incumbent upon applicant to establish criticality of that difference" *Ex parte Khusid*, 174 USPQ 59. This decision is clearly analogous to pressure differences and other process parameters.

Response to Arguments

4. Applicant's arguments filed on January 30, 2004 have been fully considered but they are not persuasive.

Applicant has argued that the motivation is required for the evidences of Collins et al. (US 6,238,588 B1), Jeng et al. (US 5,282,925), and Toprac et al. (US 6,238,937). As has been stated in the office action, The above cited references are simply evidences to show residence time is recognized result-effective variable and it is obvious to one of ordinary skilled in the art to determine the suitable residence time (adjust process parameters) through routine experimentation to obtain the best etched product achievable. See MPEP 2144.03 and MPEP 2144.05 IIA.

Applicant has argued that Yamada does not teach the process parameters such as temperature, pressure, and flow rates. As stated in the office action, "changes in compositions, temperature, concentrations, or other process conditions of a process do not impart patentability unless the recited ranges are critical (i.e., they produce a new and unexpected result that differs in kind and not merely in degree from the result of the prior art). In the absence of showing criticality or new, unexpected results, it would have been obvious to one of ordinary skilled in the art to determine the suitable said process parameters through routine experimentation in Yamada in order to produce an expected result.

Allowable Subject Matter

5. Claims 22-40 are allowed.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Collins et al. (US 6,238,588 B1, col. 2, lines 35-50), Jeng et al. (US 5,282,925, abstract), and Toprac et al. (US 6,238,937; col. 7, lines 25-25) teach controlling or adjusting residence time of etching gas in the etching process.

Changes in compositions, temperature, concentrations, or other process parameters of a process do not impart patentability unless the recited ranges are critical. *In re Woodruff*, 16USPQ2d 1934,1936 (Fed. Cir.1990); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809; *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (571) 272-1461. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you

have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

April 15, 2004

Kin-Chan Chen
Primary Examiner
Art Unit 1765